



# Herrenknecht

## Pioneering Underground Technologies

Ing. Francisco Avila, CEO, HK Panamá, HK Mexico, HK Colombia.

Santa Cruz - Bolivia, 13. noviembre 2014





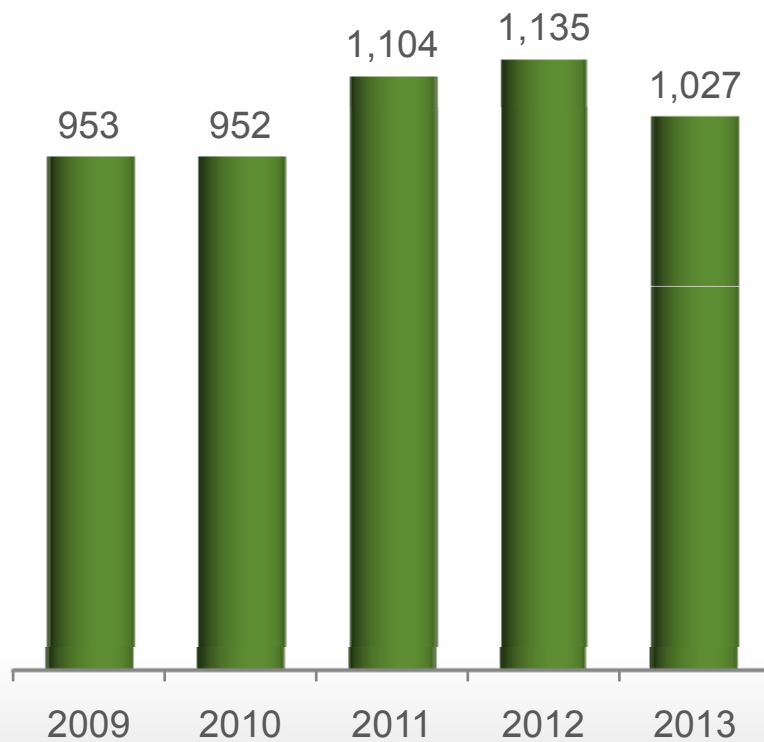
- ▶ Founded in 1977
- ▶ Conversion to Herrenknecht AG in 1998
- ▶ Today around 4,600 employees worldwide, 2,000 in Schwanau, around 200 young people in training



# Herrenknecht Group.

## Company figures.

► Total output in million Euro



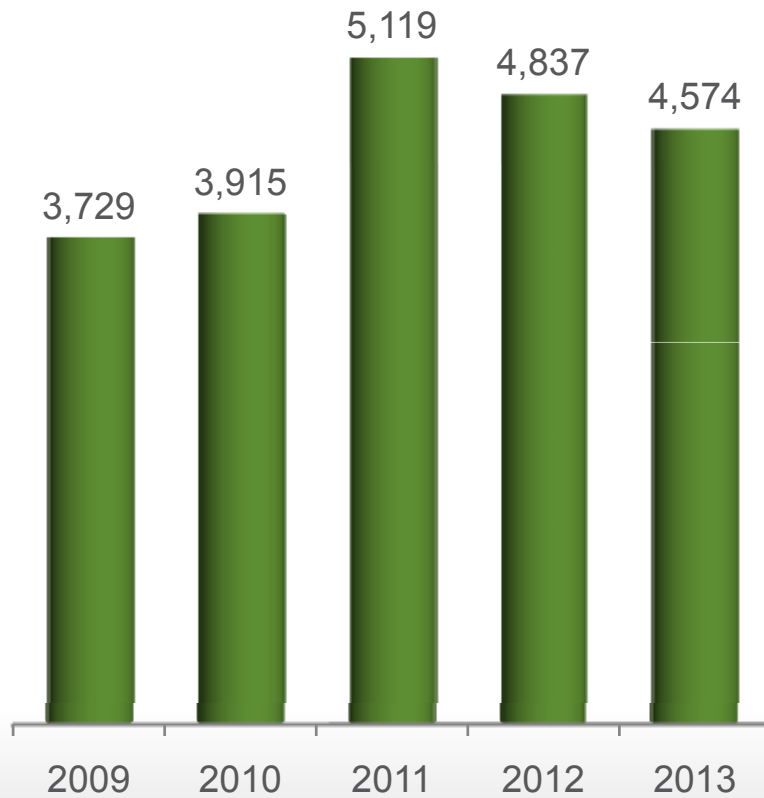
► Sales in million Euro



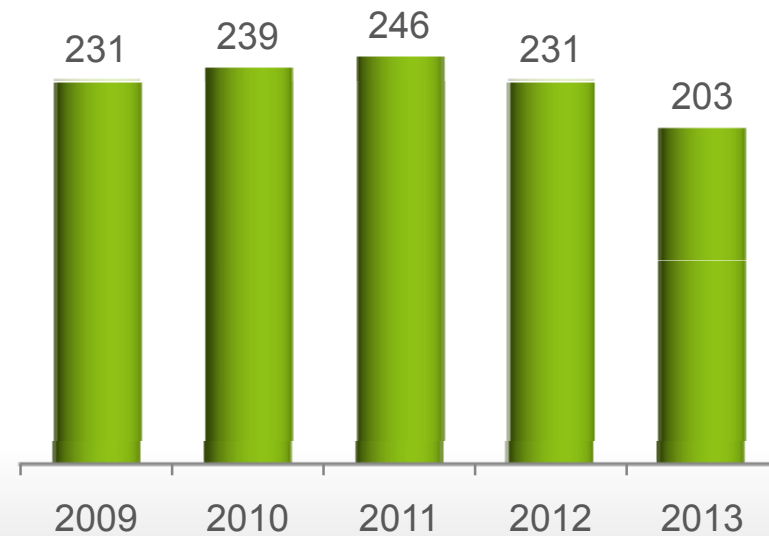
# Herrenknecht Group.

## Company figures.

► Employees\*



► Trainees













































\* Without trainees, including temporary staff

# Herrenknecht Group.

Brands and business areas.

Corporate  
Brand

# HERRENKNECHT

Core Markets	  		
Core Brands	  		
Group Brands	<p><b>Additional Equipment</b></p> <div>     </div> <div>     </div> <div>     </div> <div>   </div>	<p><b>Additional Equipment</b></p> <div>     </div> <div>     </div> <div>     </div>	<p><b>Additional Equipment</b></p> <div>   </div> <div>   </div>
	<p><b>Services</b></p> <div>   </div>	<p><b>Services</b></p> <div>   </div>	<p><b>Services</b></p> <div>   </div>

Herrenknecht. Pioneering Underground Technologies



## Herrenknecht worldwide.

The most important growth markets.

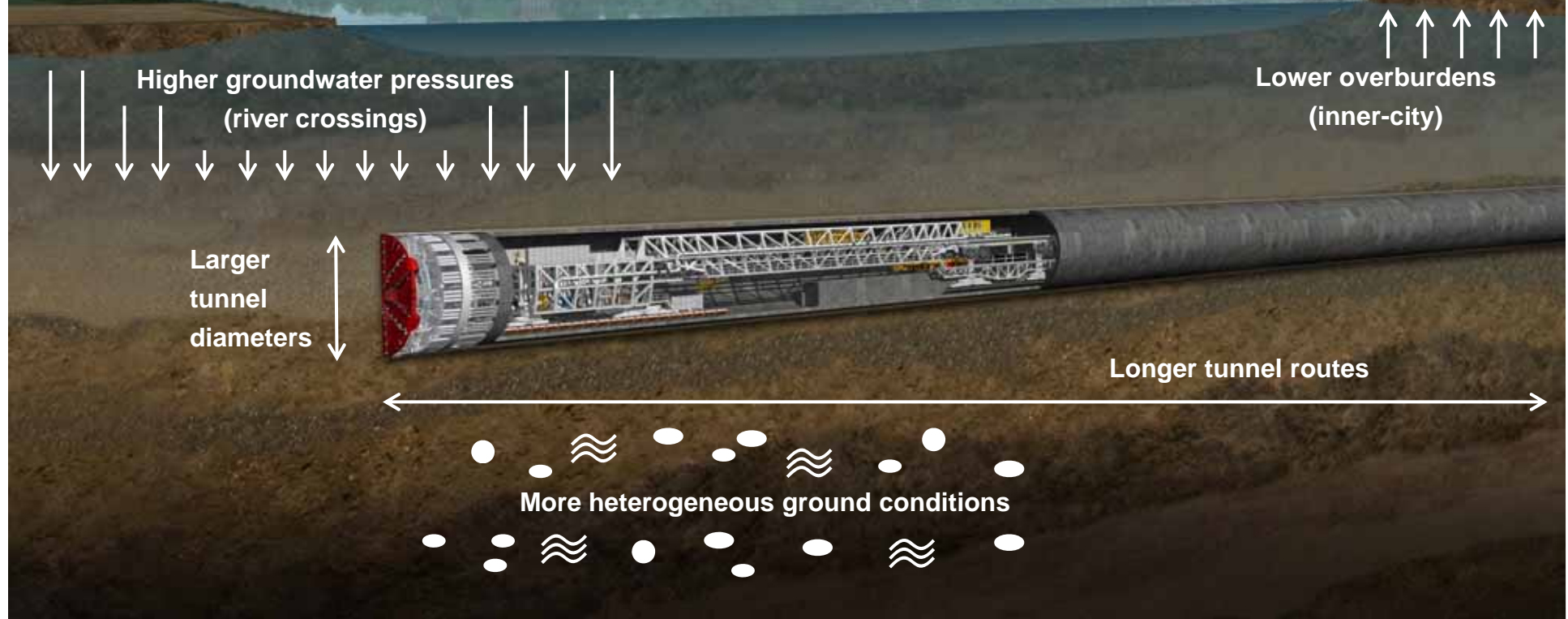


# The development of infrastructure and global trends.

- ▶ Population growth and urbanization
- ▶ Shortage of resources
- ▶ Industrialization and automation
- ▶ Increasing demand of mobility for people and goods
- ▶ Need for new supply and disposal tunnels
- ▶ Large, multi-level infrastructure projects



## Challenges in mechanized tunnelling.





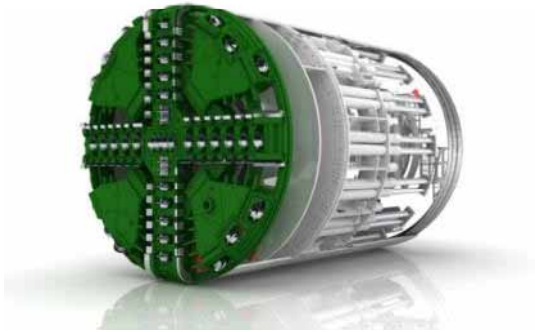


- ▶ All diameters
- ▶ All grounds
- ▶ All applications



## All Around Tunnelling Solutions.

Our core products for Traffic Tunnelling.



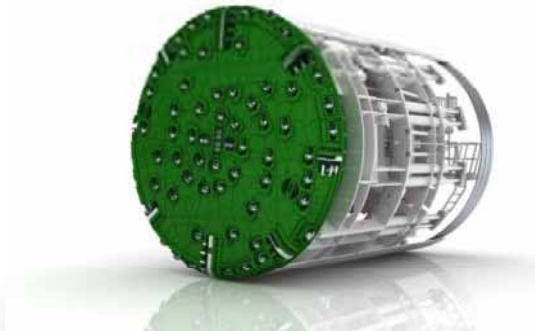
► EPB Shield



► Mixshield



► Gripper TBM



► Single Shield TBM



► Double Shield TBM

## All Around Tunnelling Solutions.

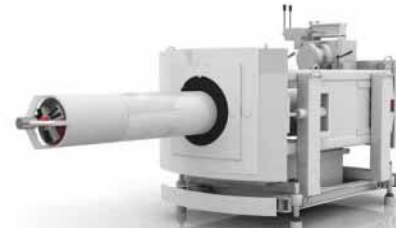
Our core products for Utility Tunnelling.



► AVN Machine



► Partial-face  
Excavation Machine



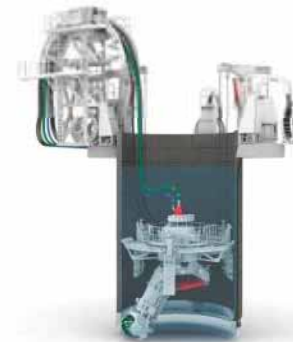
► Auger Boring Machine



► HDD Rig



► Direct Pipe®



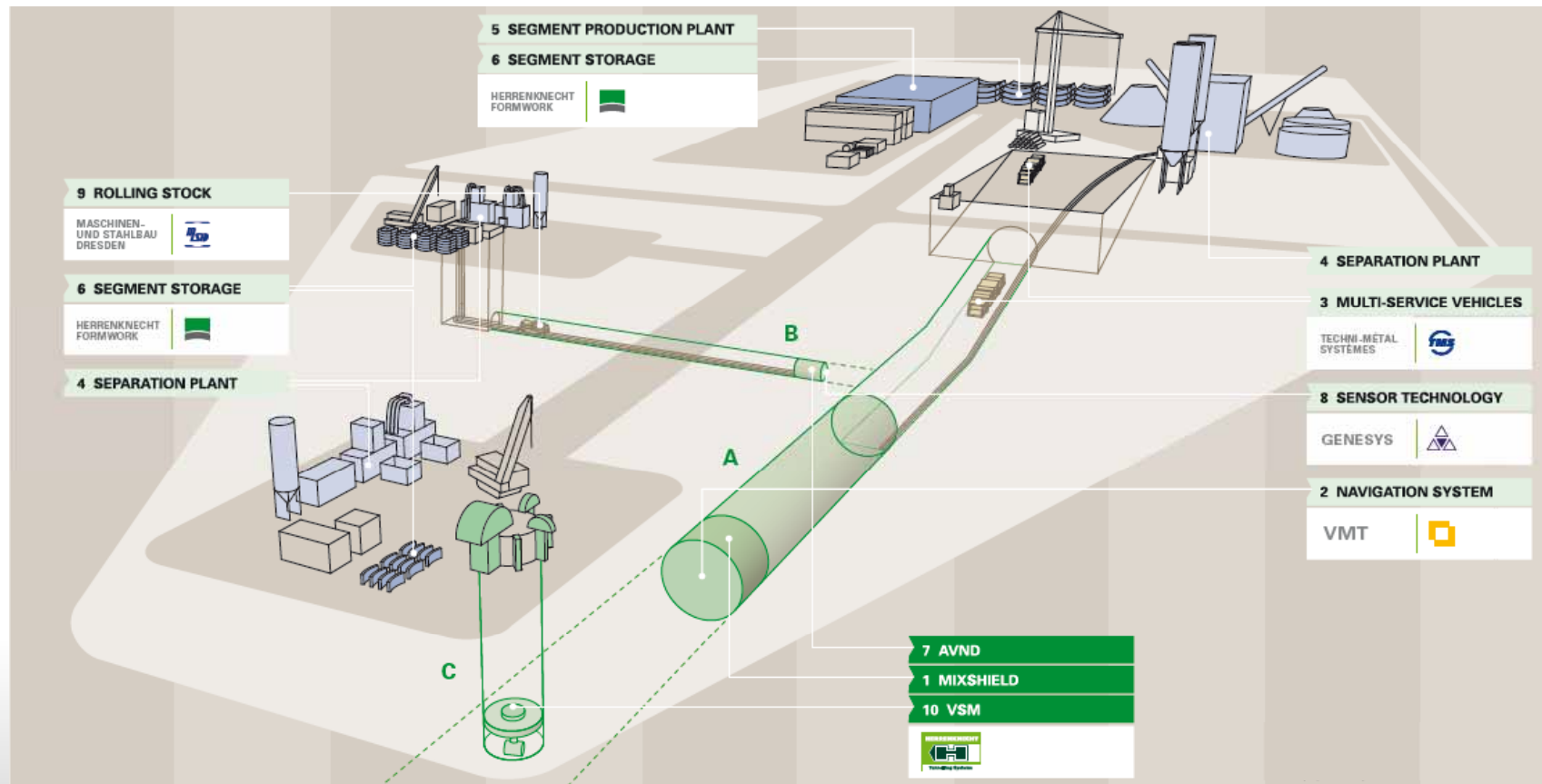
► Vertical Shaft Sinking  
Machine



# All Around Tunnelling Solutions.

Our additional equipment.

- Full-Range Tunnelling for optimized construction site logistics



Herrenknecht. Pioneering Underground Technologies



## All Around Tunnelling Solutions. Our services.

- ▶ Construction site services
- ▶ TBM personnel
- ▶ Spare and wear parts
- ▶ Excavation tools
- ▶ Refurbishment
- ▶ Rental equipment & used machines



**Herrenknecht. Pioneering Underground Technologies**





## Amudarja River Crossing in Turkmenistan.

The ultimate pipeline crossing.

- ▶ Pipeline length 1,705m; pipeline diameter 56" and 8"
- ▶ 2 x HDD Rig + Pipe Thruster

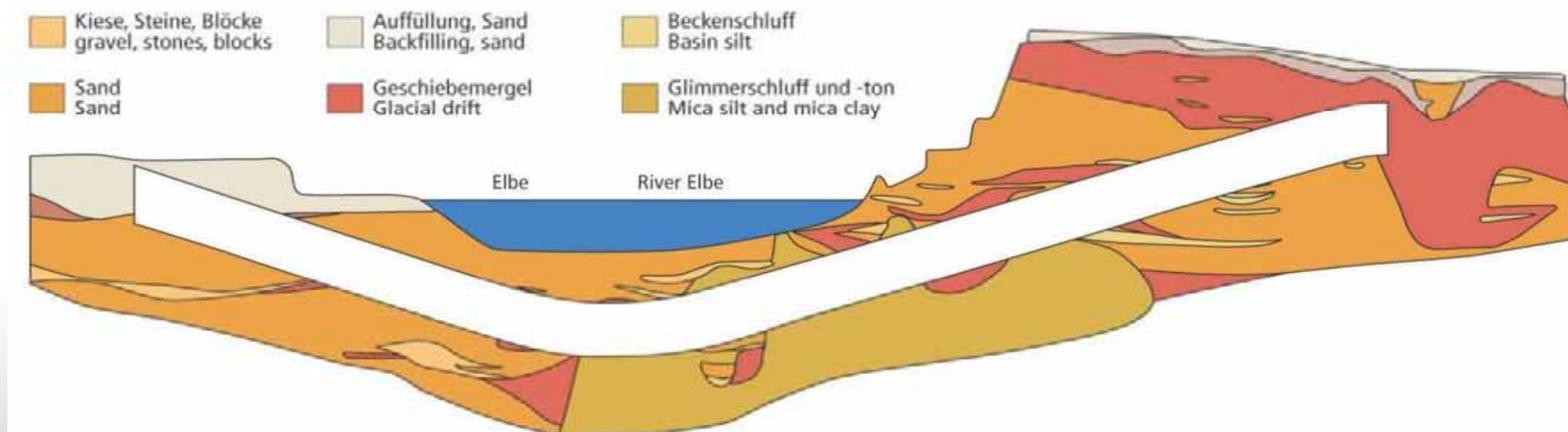




## Hamburg:

### 4<sup>th</sup> Elbe River Tunnel.

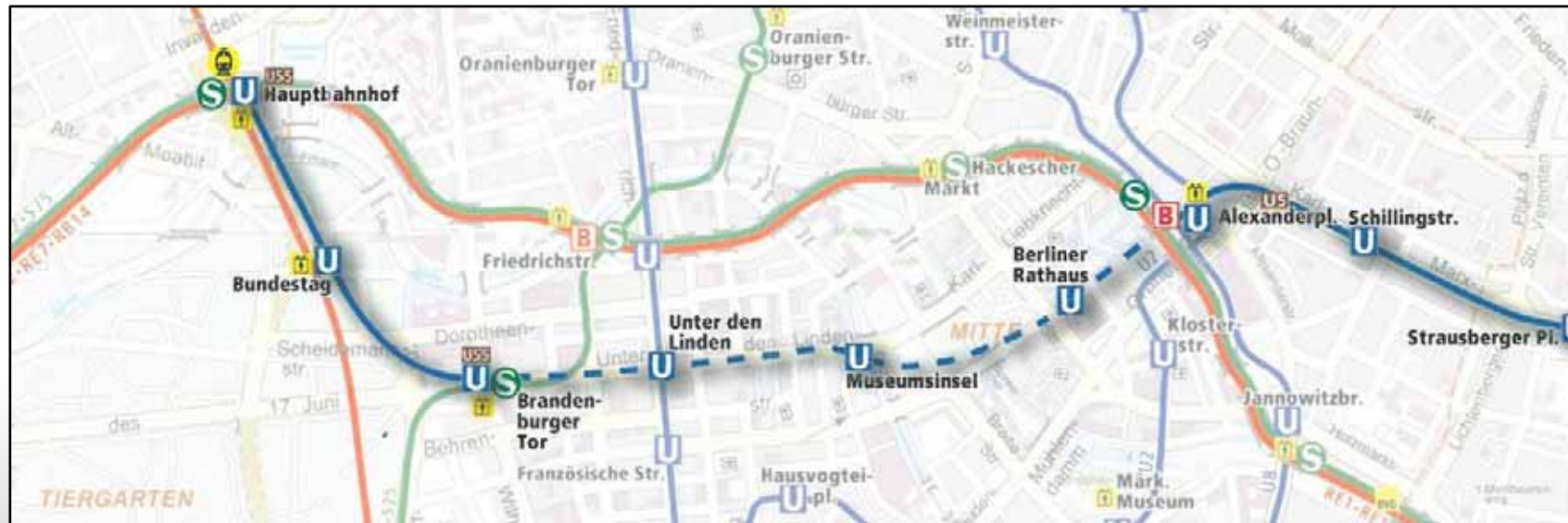
- ▶ Mixshield
- ▶ Diameter 14,200mm
- ▶ 2.6km road tunnel
- ▶ Up to 5.5 bar groundwater pressure



## Berlin U5.

Closing the gap.

- ▶ Mixshield
- ▶ Diameter: 6,670mm
- ▶ Tunnel length: 2,900m
- ▶ Tunnelling since July 2013



Herrenknecht. Pioneering Underground Technologies





## Stuttgart 21.



Herrenknecht. Pioneering Underground Technologies





# Stuttgart 21 – Fildertunnel.

- ▶ Workshop acceptance S-738, September 18, 2012
- ▶ Multi-mode TBM, Ø 10,820mm



## Stuttgart 21 – Boßlertunnel.

- ▶ Workshop acceptance S-833, February 25, 2014
- ▶ EPB Shield, Ø 11,340mm

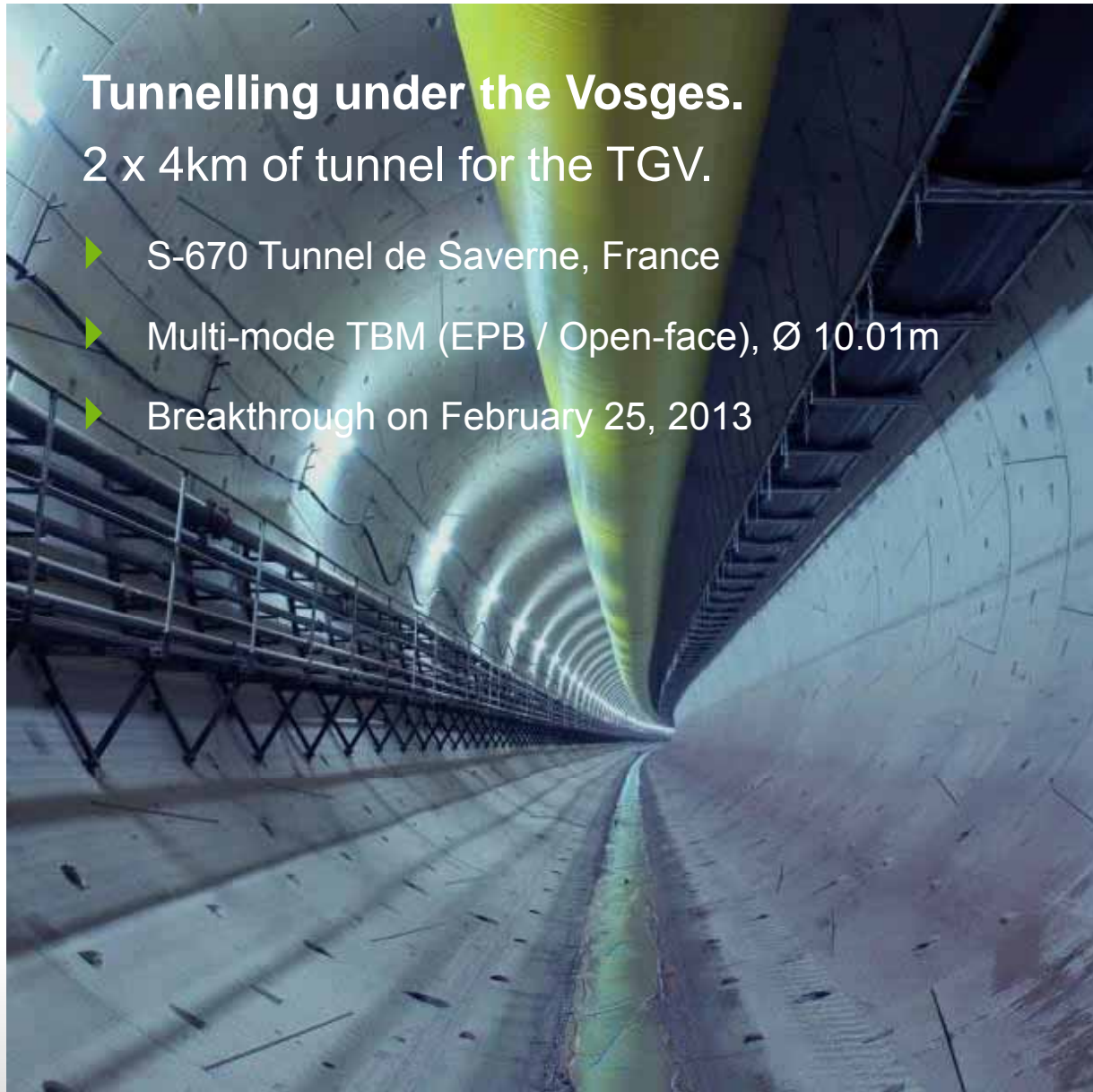




## Tunnelling under the Vosges.

2 x 4km of tunnel for the TGV.

- ▶ S-670 Tunnel de Saverne, France
- ▶ Multi-mode TBM (EPB / Open-face), Ø 10.01m
- ▶ Breakthrough on February 25, 2013





**S-300 for Madrid – diameter 15.20 meters.  
Maximal torque 125,268kNm.**



**Herrenknecht. Pioneering Underground Technologies**





# Hallandsås Railway Tunnel.

Outstanding pioneer work  
by Teamwork Tunnelling.



Herrenknecht. Pioneering Underground Technologies





## Final breakthrough of Herrenknecht's largest EPB Shield.

S-574 Galleria Sparvo, Ø 15.55m.

- ▶ Best performances of 24m per day and 126m per week
- ▶ Tunnelling of 4.9km in total successfully finished after only two years



## London: Crossrail.

One of Europe's largest construction projects.

- ▶ Herrenknecht delivers all TBMs: 6 x EPB Shield + 2 x Mixshield
- ▶ 42km of railway tunnel in total





## London: Crossrail.

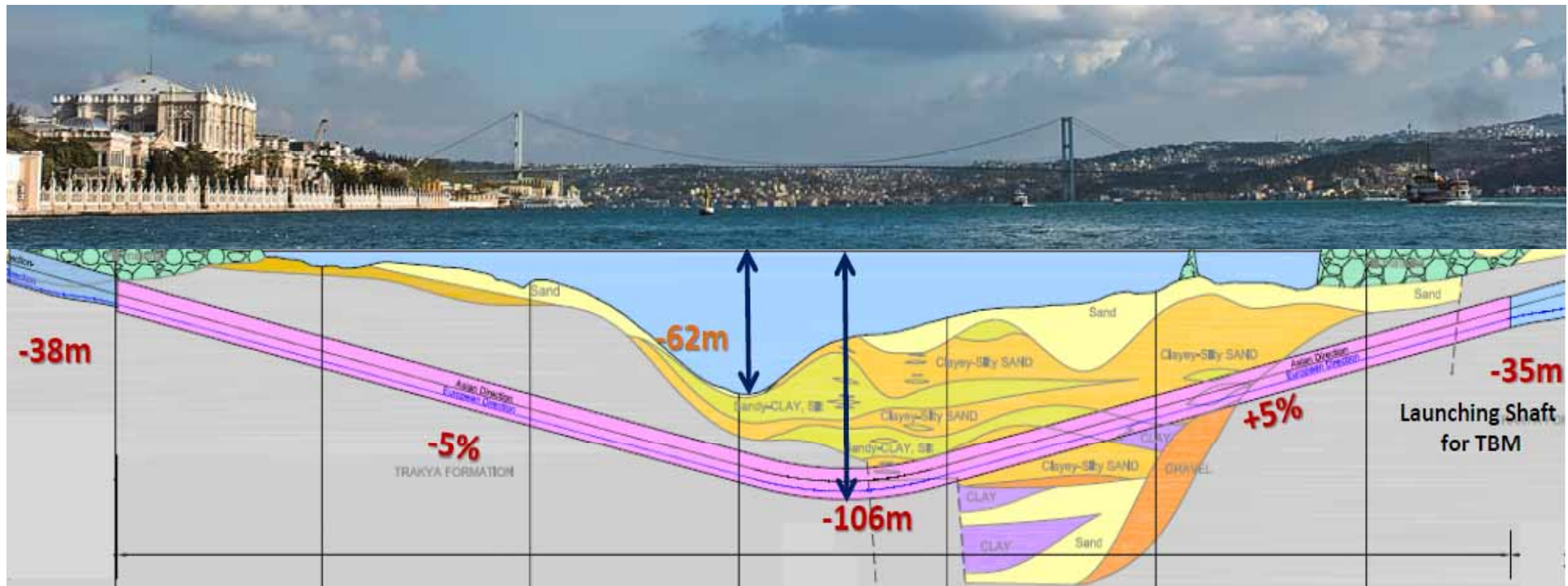
- ▶ Tunnelling since May 2012
- ▶ First breakthrough in May 2013



# Creating connections between Europe and Asia.

## Istanbul Strait Road Tunnel Crossing Project.

- ▶ Mixshield, Ø 13,660mm
- ▶ First road tunnel (3.34km) under the Bosphorus
- ▶ Up to approx. 100m below sea level
- ▶ Custom-made solutions for extreme water pressure





## Sochi: Olympic tunnelling.

New infrastructures for the winter games 2014.

- ▶ S-517, EPB Shield: Railway tunnel No. 5
- ▶ S-534, Single Shield TBM: Road tunnel No. 3



# Gotthard Base Tunnel.

The Champions League of tunnel construction.



June 16, 2009



September 16, 2009



October 15, 2010



March 23, 2011



Herrenknecht. Pioneering Underground Technologies





The lined tunnel.



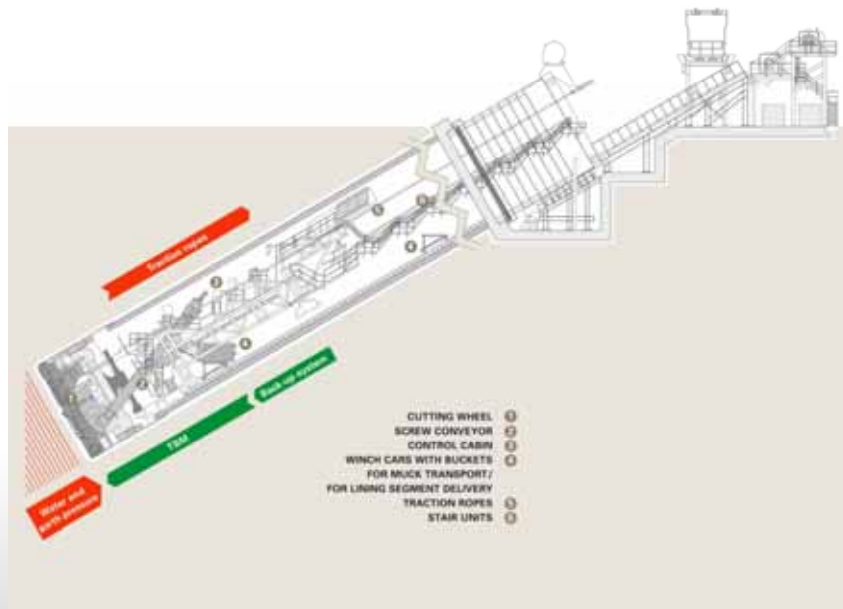
**Herrenknecht. Pioneering Underground Technologies**



## Tailor-made solutions for special challenges.

### Declined and inclined tunnels.

- ▶ St. Petersburg, EPB Shield, Ø 10.69m
- ▶ 30° decline, tunnel length 120m
- ▶ Escalator shaft for metro station
- ▶ Limmern, Gripper TBM, Ø 5.20m
- ▶ 40° incline, tunnel length 2 x 1,023m
- ▶ Shafts for pumped-storage power plant







Herrenknecht. Pioneering Underground Technologies





# Shanghai Changjiang Under River Tunnel Project.

A milestone in the development of the Mixshield technology.

- ▶ Diameter: 15,430mm
- ▶ Tunnel length: 2 x 7,470m
- ▶ Tunnel route up to 65m deep under the Yangtze river (groundwater pressure up to 6.5 bar)
- ▶ Breakthrough 12 and 10 months earlier than planned

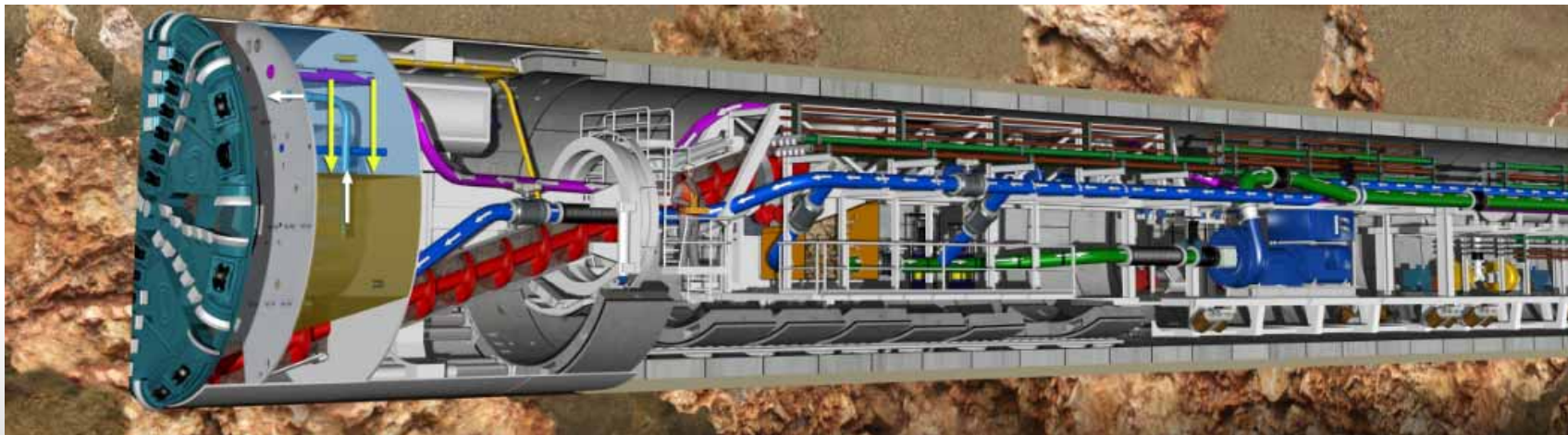




## A world's first in mechanized tunnelling.

Variable density technology for Kuala Lumpur.

- ▶ Klang Valley MRT Project
- ▶ 9.8km tunnel
- ▶ 6 x Variable Density TBM, Ø 6,620mm
- ▶ Combination of EPB Shield and Mixshield
- ▶ Variation of density of suspension possible



Herrenknecht. Pioneering Underground Technologies



## Port of Miami Tunnel.

Relief for downtown Miami.

- ▶ EPB Shield, Ø 12,860mm
- ▶ Innovative „Water Control Process“ (WCP): EPB mode + water-slurry mode possible
- ▶ Final breakthrough May 6, 2013
- ▶ Tunnel commissioning mid-2014





## The innovative Direct Pipe® technology.

Single-step installation for pipeline crossings.

- Fast and safe installation of product pipes and pipelines



## Direct Pipe®.

### Project success in the USA.

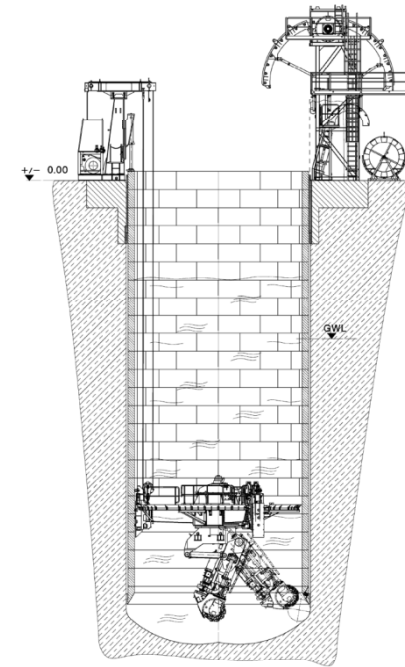
- ▶ Crossing under a highway in Arcadia, Florida
- ▶ Installation of 215 meters of pipeline in only three days of tunnelling
- ▶ No settlement or heave above ground





## America's first mechanized shaft construction. Ballard Siphon Replacement Project in Seattle.

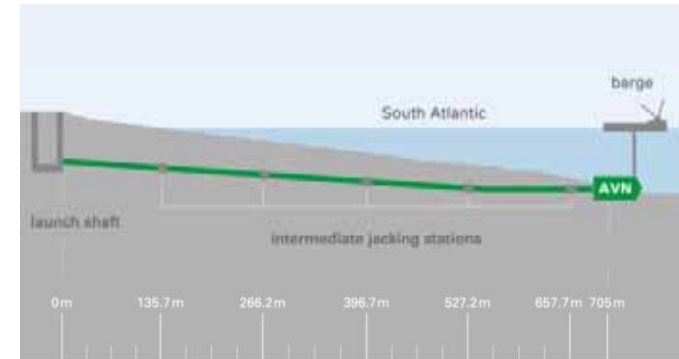
- ▶ 45 meter-deep launch shaft for microtunnelling
- ▶ Advance rates of up to 2.6 meters per shift
- ▶ High work safety, low noise emission and reduced construction time compared to conventional methods
- ▶ Shaft sinking below groundwater possible



## Brazil: Santos Sea Outfall.

Pipe jacking directly under the sea.

- ▶ AVN1500TB, Ø 1,810mm
- ▶ Tunnel length 2,126m





## Abu Dhabi: Strategic Tunnel Enhancement Programme (STEP).

Lots T-02 and T-03.

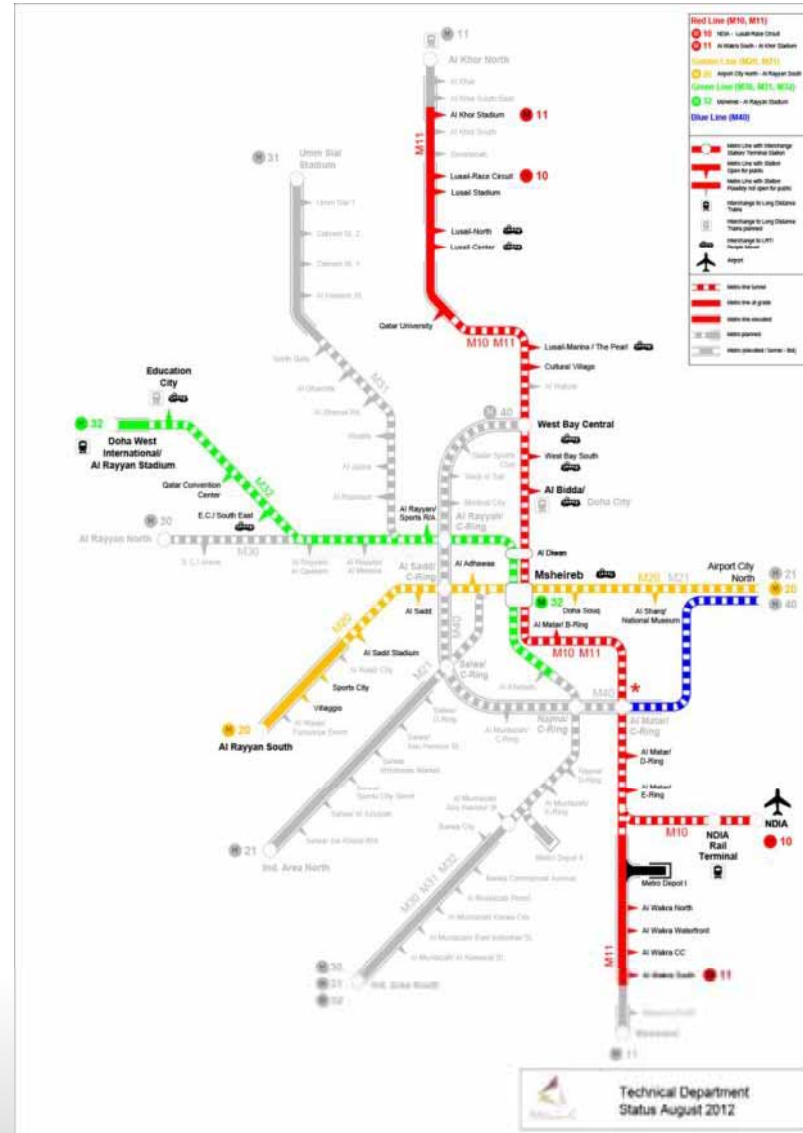
- ▶ 5 x EPB Shield for 25.2km of sewage tunnel
- ▶ Final breakthrough: December 2012
- ▶ Rolling Stock by MSD and lining segment plant by Herrenknecht Formwork



# Traffic Tunnelling in Qatar.

# Doha Metro.

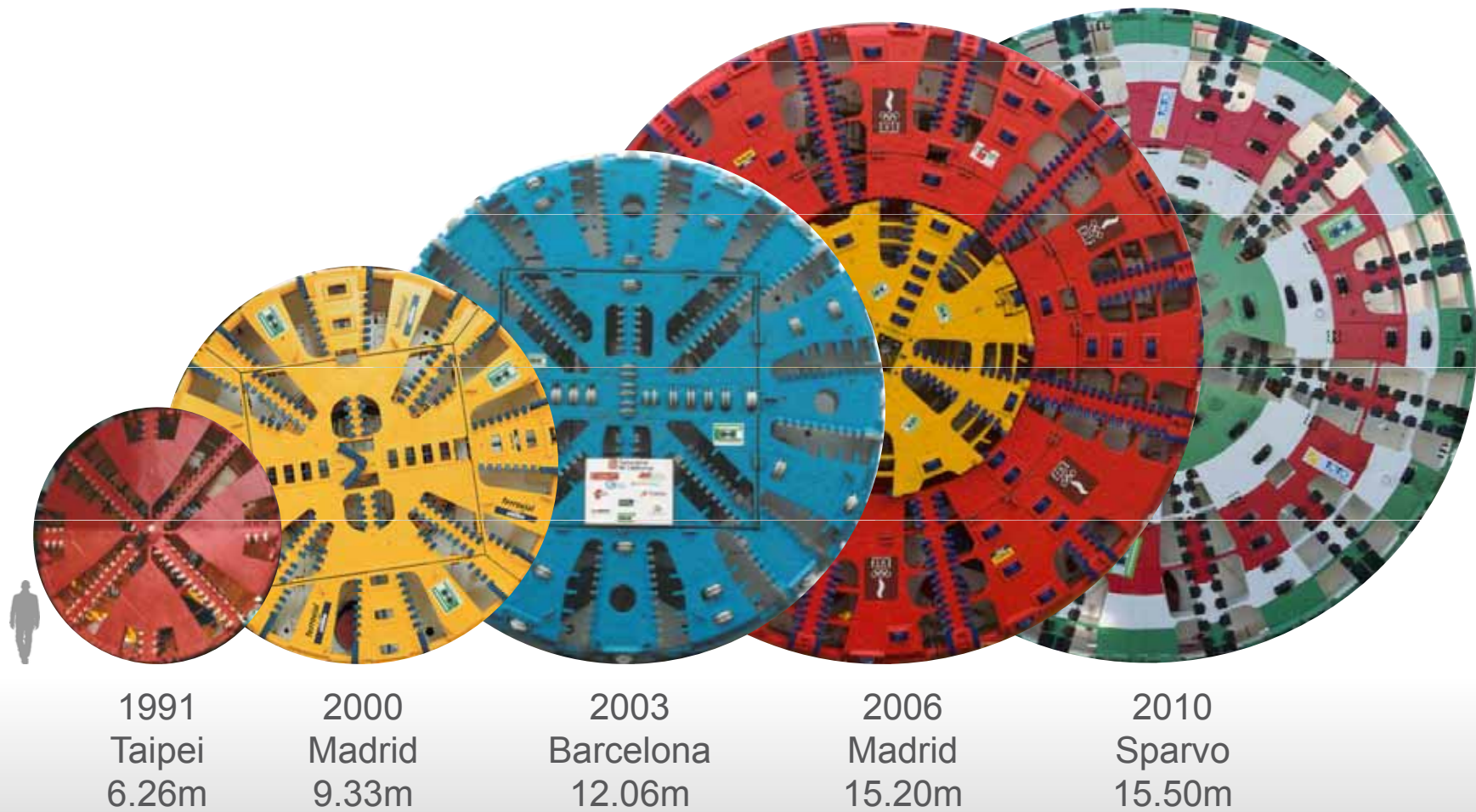
- ▶ 21 x EPB Shield for 4 new lines
- ▶ More than 100 kilometers of tunnel in total
- ▶ Herrenknecht only TBM supplier
- ▶ Full Range Solution from the Group: navigation systems, belt conveyors, segment moulds, Multi-service vehicles and comprehensive services





## Development of shield diameter.

EPB Shields.

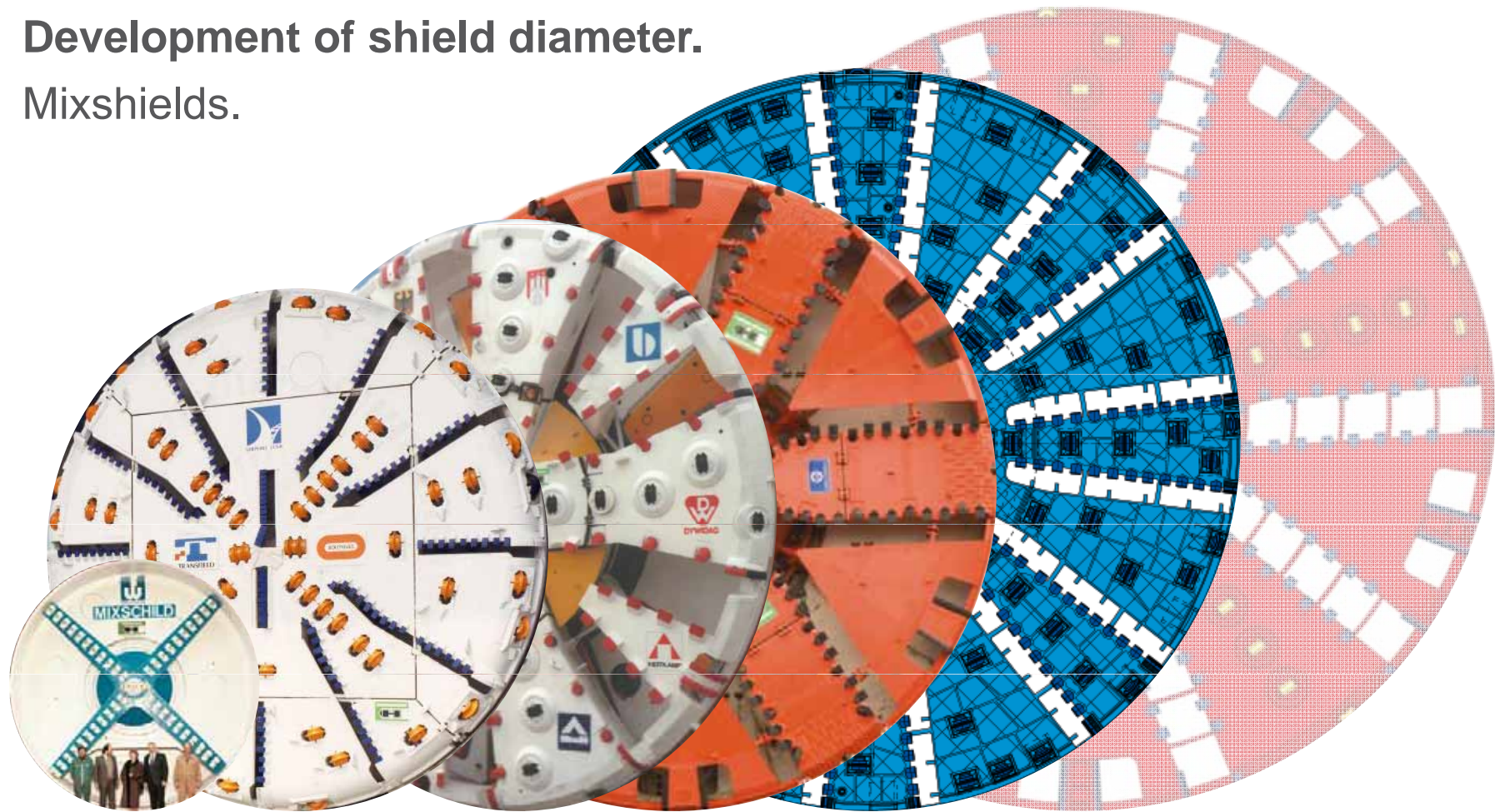


Herrenknecht. Pioneering Underground Technologies



## Development of shield diameter.

Mixshields.



1985  
HERA  
5.95m

1996  
Sydney  
10.70m

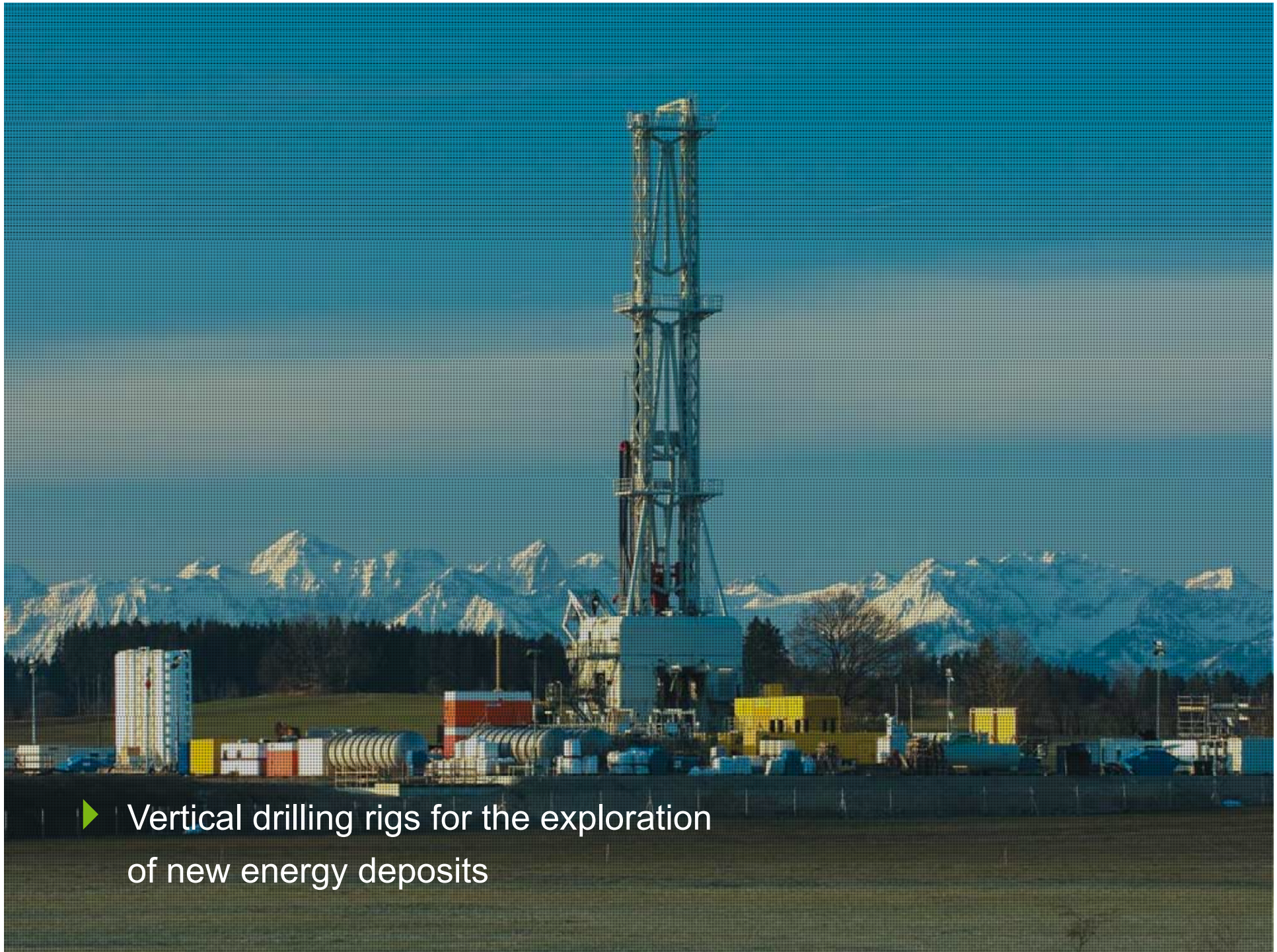
1997  
Hamburg  
14.20m

2006  
Shanghai  
15.43m

2013  
Hong Kong  
17.6m

Concept  
St. Petersburg  
19.25m





- ▶ Vertical drilling rigs for the exploration of new energy deposits



## Herrenknecht Vertical GmbH.

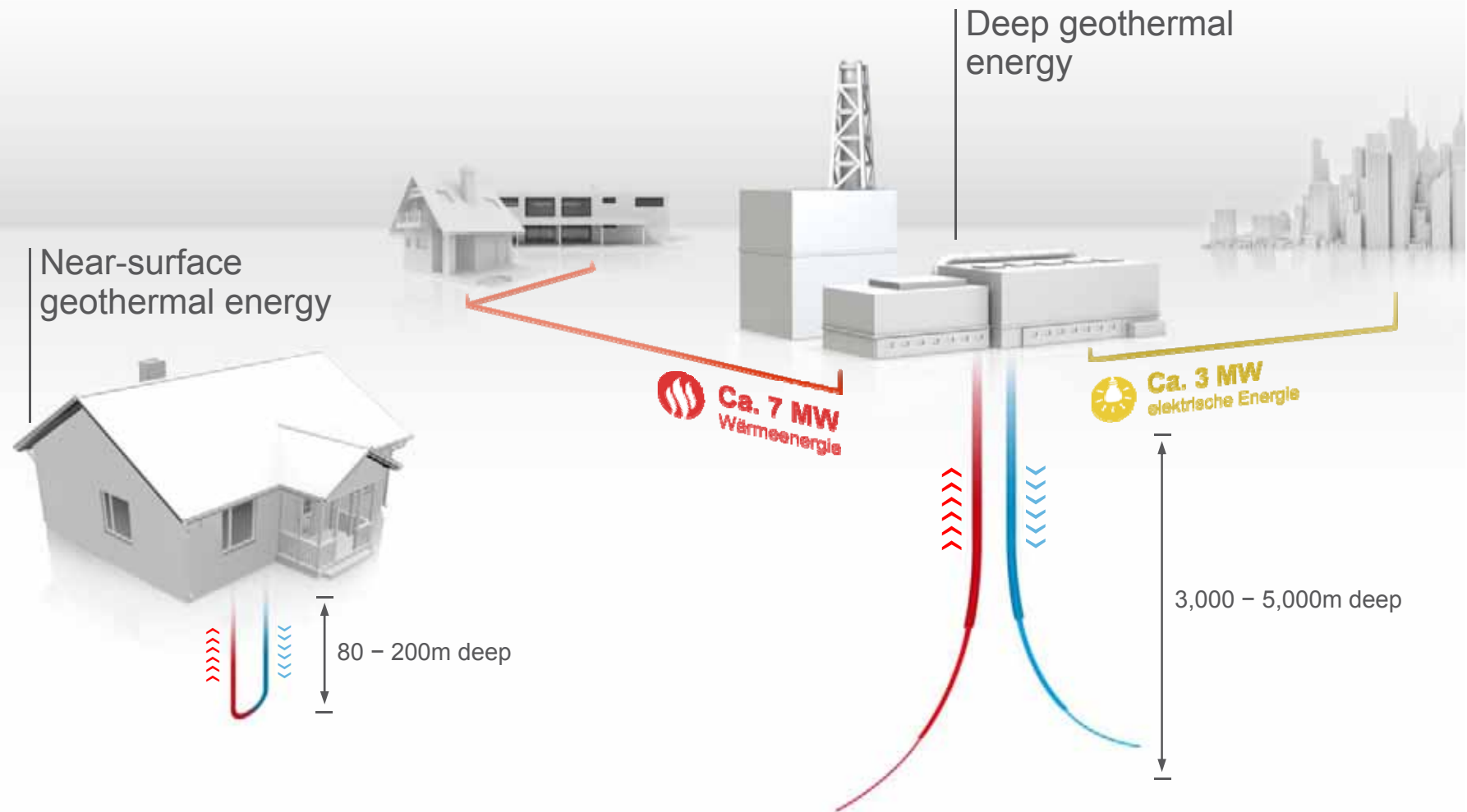
- ▶ Subsidiary (100%) of Herrenknecht AG
- ▶ Founded March 2005
- ▶ Schwanau
- ▶ Deep drilling rigs for the exploration of oil and gas deposits as well as geothermal energy sources
- ▶ Advantage in technology thanks to hydraulic drive engineering
- ▶ Comprehensive automation
- ▶ Staff savings





## Geothermal energy.

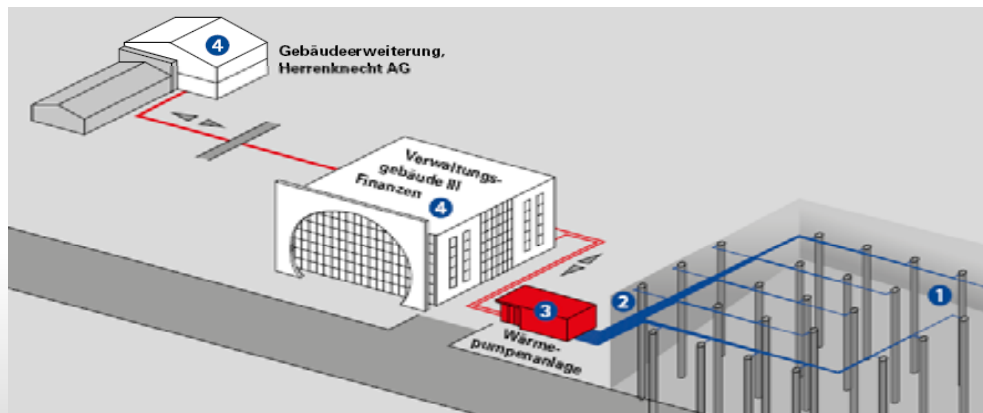
Potential for a clean and stable energy supply.



# Utilization of near-surface geothermal energy.

## Herrenknecht headquarters in Schwanau.

- ▶ Herrenknecht Office Building No. 3
  - ▶ 32 drills up to 100m in depth
  - ▶ Overall heat / cold release of heat pump system: 324,000kWh +/- year
  - ▶ Savings of 31 tons of CO<sub>2</sub> / year compared to conventional heat systems



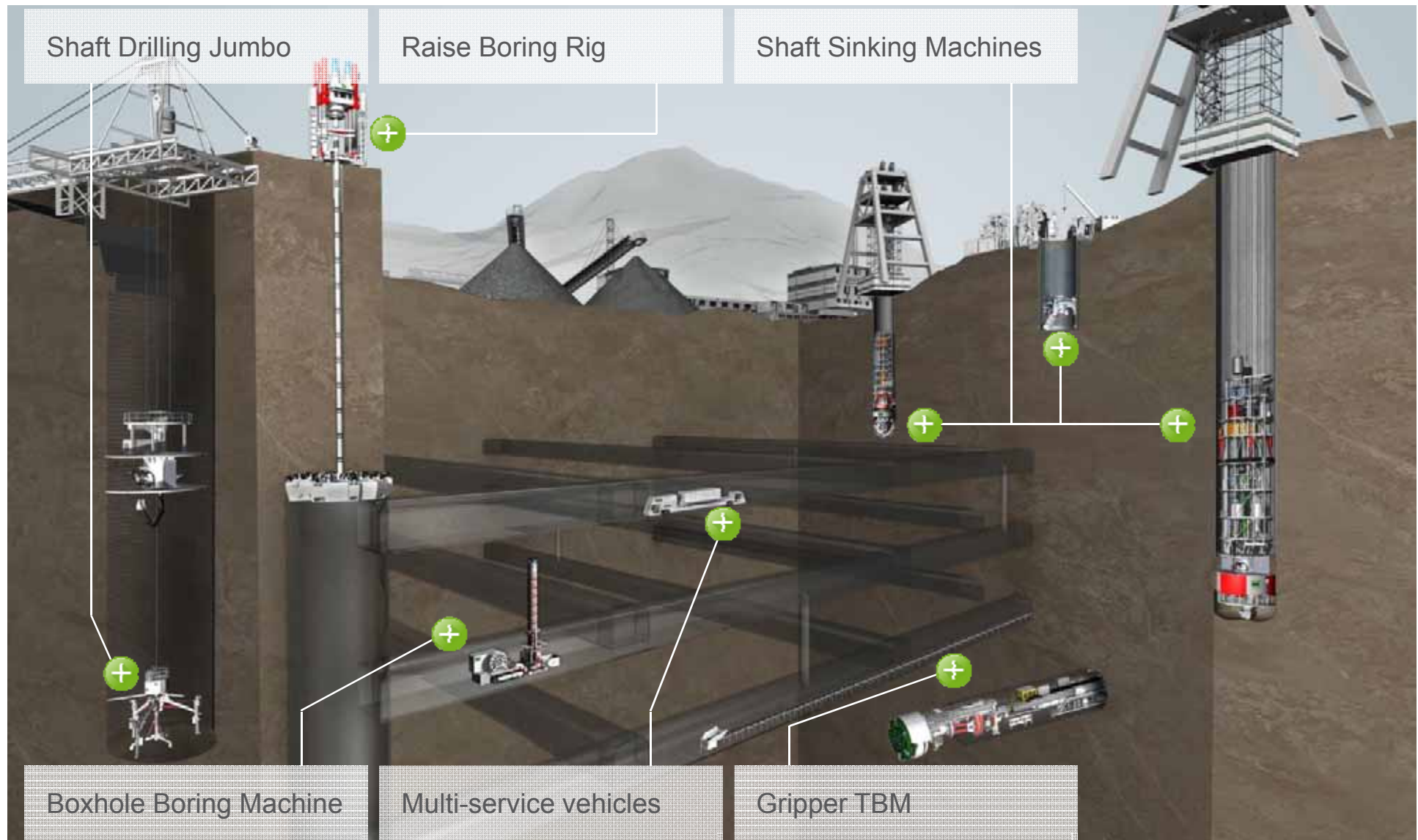






# Herrenknecht Mining.

## Product portfolio.





A man wearing a red hard hat and a dark jacket is looking upwards in a dimly lit tunnel. The tunnel walls are rough and textured, with a small light source visible on the left wall. The overall atmosphere is one of exploration and discovery.

► **Together we are building our future.**

**Herrenknecht. Pioneering Underground Technologies**

